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NOTES ON THE BIOLOGY OF STAGMOMANTIS CAROLINA. (ORTHOPTERA, MANTIDAE).

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My first work with the common mantid, *Stagmomantis carolina* John. began accidentally. One afternoon in early May, at Dallas, Texas, a number of egg masses of the mantid were placed on my desk for inspection. In looking them over I noticed that several had been parasitized and that in others the nymphs had already emerged. I paid very little attention to the unhatched eggs. The next morning May 7, 1927, my desk was covered with numbers of ungainly little brownish green creatures that raced madly about and made frantic efforts to hide behind books and papers. Thirty of these mantid nymphs were captured and placed under a glass lantern globe. A week later a second egg mass hatched. These two broods, together with a stray nymph I found, furnished me with material for observations throughout the summer.

To Mr. E. W. Laake of the U. S. Bureau of Entomology I am indebted for caring for the mantids while I was away from the office on field work. Mr. A. N. Caudel of the U. S. National Museum has very kindly identified the mantids. The parasitic diptera were determined by Dr. J. M. Aldrich.

BREEDING CAGES.

For breeding cages, glass lantern globes 12 inches tall and 6 inches in diameter proved very successful. The open tops of these cages were covered with cheesecloth. Strips of paper or gummed labels stuck on the inner surface of the glass made it easy for the mantids to crawl about the sides and top of the cages. These glass globes were then placed in earthenware saucers. Within the cage a hackberry twig with several leaves attached was held upright in a glass vial partially filled with water and plugged with cotton. The mantids spent most of their time on these leaves or on the roof of the cage. It was important that the cages never be placed in strong, direct, summer sunshine as death to the insect nearly always resulted from overheating in this manner.

FOOD

It was soon discovered that the mantids were cannibalistic. When the nymphs were not fed during the first two days following hatching, they began eating each other. For the first few weeks they were fed entirely on aphids from a cottonwood tree. This was done by merely breaking off aphid infested twigs and placing them in the cages. After this they were given a diet consisting almost entirely of house-flies. On a few occasions they were offered other food which they usually accepted. I can corroborate the statement of Rau that mantids will not eat the larvae of the bag worm. When flies were placed in a cage, the mantid usually took a position on a twig near the side of the cage and rapidly caught the flies as they flew or crawled near him. Often a mantid would be greedily

eating two flies at the same time and trying to catch a third. Usually five flies a day would satisfy large nymphs but as they neared maturity they often ate nine or ten flies per day. After copulation a female was fed as many as 15 flies a day for several days, all of which she ate ravenously.

It was noted that mantid nymphs always refused food for one or two days preceding the moult. Since these mantids thrived by being fed on house flies nearly all their lives, I am convinced that they do not need a variety of diet as suggested by Rau. Due to their cannibalistic habits it was necessary that each mantid be placed in a separate cage. It is perhaps possible to rear two or three in the same cage but usually the weaker will fall prey to the stronger.

One of the most important requirements in raising the mantids was to supply the correct amouint of moisture. Fortunately a satisfactory plan was found at once. After several nymphs were drowned in water contained in a watch crystal this method was discontinued and moisture was supplied by sprinkling a few drops of water each morning on the twigs and leaves in the cage. The stems of the aphid infested twigs were stuck in a vial of water, the mouth of which was closed with a cotton plug which also furnished moisture. The only time the mantids seemed to suffer from lack of moisture was at the moulting periods. One mantid upon moulting to an adult had a permanently crippled wing, which presumably was due to lack of moisture.

AN INTERESTING CASE OF PARASITISM

While usually the mantids were fed on the house fly, *Musca domestica* Linn., they were often given larger flies of various species. They did not seem to fear the large metallic flies of the genera *Phormia* and *Lucilia* though they did not so readily attack the screw-worm fly, *Cochliomyia macellaria* Fab. Seizing a fly a mantid would tear off large pieces and seemingly swallow them whole. On one occasion a mantid devoured a house fly completely in 45 seconds. Such a performance proved the undoing of one adult mantid. It was found lying on the floor of the cage and issuing from its body was a number of fly maggots. These larvae were placed in a glass jar which was protected with a metal cover against possible visits of other flies. The maggots were fed on carefully inspected beef liver which was free from fly eggs, and 13 flies were reared to maturity. The adults were identified as belonging to two species of *Sarcophaga*. One species being *Sarcophaga assidua* Walker, the other species has not been determined. It is interesting to note that there was no sand or dirt present in the cage and the mantid was never exposed to the attack of flies, except as flies were put in the cage for food. As the mantid had been injured in no way it is not likely that it was blown by the Sarcophagids. It is easier to conceive of the mantid swallowing the eggs or the embryonic larvae in taking large bites from the bodies of female flies. Both the mantid and the flies were mounted and have been preserved.

MOULTS

According to Didlake the normal number of moults for the female of *Stagmomantis carolina* is seven. Below is presented the record of a female kept under observation from the egg, through the moults, to copulation, egg laying and death. This mantid moulted eight times as is shown in Table 1.

Table 1. Record of mantid No. 1A ♀

Date	Moult	Days after hatching	Remarks
May 7, 1927			Hatched on this date.
May 19,	1st	12	
May 28,	2nd	21	
June 9,	3rd	33	
June 25,	4th	49	
July 5	5th	59	
July 18	6th	72	
July 29	7th	83	Adult stage reached. Wing crippled in moult.
Aug. 15	8th	100	
Sept. 5		121	Mated with ♂ C (noon).
Sept. 12		128	Egg mass produced (6 a.m.)
Oct. 2		148	Died.

MATING

The male that was mated with the female referred to above moulted six times under observation but since it was taken in the nymphal stage the exact number of moults was not determined. The mating of the two mantids was as interesting as copulation always is among the mantids. At 12 o'clock (noon) on Sunday, August 5, the mantids were fed a number of flies and then placed together on a desk. They sat very quietly for two minutes without seeming to notice each other. Without any courtship the male suddenly leaped upon the female clasping her around the thorax with his forelegs.

Within 30 seconds he had twisted the tip of his abdomen around to the left and they were in copulation. They remained linked together for 5½ hours though actual mating appeared to have occurred within the first hour.

During the entire process the female remained undisturbed. She busied herself cleaning her face and feet after the manner of a cat. Twice flies were offered her which she accepted and hastily ate. The pair often moved about over objects on the desk but most of the time they were kept under a bell jar containing moisture.

At 5.30 p.m. the male pulled away from the female and although weak and exhausted he ran away from the female, but true to tradition she turned and leaped quickly upon him. Grasping him with one foreleg around the prothorax and the other around the abdomen, she began her wedding feast. First she bit through his abdomen, then through his forelegs, and started eating a wing. Convinced that the male was being eaten I saved him that he might be identified. Upon taking him away from the female she attacked my finger, breaking the skin with her strong jaws.

EGG LAYING

Seven days later, August 12, the female mantid produced an egg mass. These eggs were cemented to a narrow wooden strip which had been placed in the roof of the cage. The eggs have been protected from parasites and should hatch in the spring of 1928.

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ANTHIDIINAE COLLECTED MOSTLY IN CANADA (HYMENOP).

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Through the courtesy of Dr. J. McDunnough I was recently privileged to examine the collection of Anthidiine bees in the Entomological Branch of the Canadian Department of Agriculture, including both identified and unidentified material. The list of species determined or confirmed follows, with comments.

Anthidium tenuiflorae Cockerell.

Fort Wrigley, McKenzie River, July 25, 1922 (C. H. Crickmay), 2 ♂ ♂, 1 ♀; Fort Norman, McKenzie River, August 6, 1922 (C. H. Crickmay), 1 ♀; Northwest Territory, 1 ♀; Invermere, B.C., June 30, 1914 (F. W. L. Sladen), 4 ♂ ♂, 3 ♀ ♀; Penticton, B.C., June 29, 1919 (E. R. Buckell), 2 ♂ ♂, 1 ♀; Lethbridge, Alberta, June 28, 1914 (F. W. L. Sladen), 1 ♂; Banff, Alberta, July 24, 1911 (Sanson), 1 ♀; Calgary, Alberta, July 18, 1917 (F. W. L. Sladen), 2 ♂ ♂; Melfort, Sask., July 20, 1916 (F. W. L. Sladen), 1 ♂; Saskatoon, Sask., July 17, 1914 (F. W. L. Sladen), and July 18, 1909, 2 ♂ ♂; Melfort, Sask., July 20, 1916 (F. W. L. Sladen), 1 ♂; Regina, Sask., July 9, 1916 (F. W. L. Sladen), 2 ♂ ♂, 1 ♀; Swift Current, Sask., Aug. 23, 1916 (F. W. L. Sladen) 2 ♂ ♂.

A. tenuiflorae has previously been reported by Cockerell from localities in Saskatchewan and from Calgary, but Fort Norman and Fort Wrigley in the

Northwest Territory represent, I believe, localities far north of the previously known range of this insect, Fort Norman being in the same latitude as the southern part of Great Bear Lake. However, a subspecies—*yukonense*—was recently described by Cockerell from Carcross, Yukon Territory.

Anthidium utanense Swenk

Vernon, B. C., July 23, 1920 (F. W. L. Sladen), 1 ♂, and (M. H. Ruhmann), 1 ♀ ; Lillooet, B. C., June 13, 1918 (A. W. A. Phair), 2 ♂ ♂ ; Invermere, B. C. June 30th, 1914 (F. W. L. Sladen), 1 ♂ ; Keremeos, B. C., July 21, 1917 (F. W. L. Sladen).

Anthidium nebrascense Swenk

Kaslo, B. C., June 3, 1906 (Cockle), 1 ♂, June 11, 1905 (Cockle), 1 ♀, and Aug. 3, 1916 (F. W. L. Sladen), 4 ♂ ♂ ; Penticton, B. C., June 29, 1919 (E. R. Buckell), 1 ♂ ; Summerland, B. C., Aug. 10, 1916 (F. W. L. Sladen), 2 ♂ ♂ ; Keremeos, B. C., July 21, 1917 (F. W. L. Sladen), 1 ♀.

In the majority of these males segment 3 as well as segment 2 is four-spotted. There is a faint spot also on the tubercles of four of the specimens, and in not all of them are there spots on the knees. These departures from the normal seem, however, to be individual variations and in general the specimens agree so well with Swenk's description that they are assigned to *nebrascense*.

The two females noted above agree fairly closely with Swenk's description of his allotype, although one of them lacks maculations on the femora (agreeing in this respect with the male type) and the other has on segment 1 of the abdomen two small discal spots in addition to the larger lateral spots (a direction of variability provided for in the description of the male) and has the axillae as well as the scutellum maculated.

Two other specimens—both from Kaslo, B. C., the one taken by Cockle, the other by Sladen, Aug. 3, 1916—may be *nebrascense*, which they resemble structurally. They have the tibial maculations much more strongly developed at the apex than at the base, in this respect being suggestive of the other individuals of the group. But in many respects they depart widely from the accepted standard. Both of them have the clypeus largely yellow and segment 6 mostly yellow except for a narrow bisecting line of black. One of them has L-shaped bands bounding the mesoscutum and merely a medianly divided band with posterior emarginations on segment 1. This specimen is much more like *mormonum* (*blanditum*), even with respect to the contour of segment 6, but structurally the other females also resemble *mormonum* (*blanditum*), so that there is still the possibility that these highly maculated specimens merely represent aberrations.

A. nebrascense is a species of wide distribution, having been reported not only from the state from which it takes its name but also from Wyoming, Idaho, and California. The above specimens, however, appear to be the first records from Canada that have found their way into print, unless it be that the species has been described under some other name. It is possible, for instance, that *wallisi* is an undermaculated specimen of this group. The specimens here identified as *nebrascense* were indeed associated by some previous worker with the type of *wallisi*. The concentration of the maculations at the apex rather than the base of the tibiae in *wallisi* and the absence of the inner maculations on the first abdominal segment are strongly suggestive of the condition in *nebrascense*. If

wallisi be indeed merely an aberrant representative of the species hitherto known as *nebrascense*, the latter will have to give way to it under the law of priority. Such a relegation of *nebrascense* seems as yet, however, premature. I am informed by Dr. McDunnough that Mr. Brown, who kindly undertook the comparison of the Kaslo specimens with *wallisi*, "sees no particular reason for considering them as conspecific with the type" and Professor Cockerell, who described *wallisi*, subsequently recorded *nebrascense* without associating it with his species.

Anthidium cognatum Cresson

Florida, 2 ♂ ♂.

Anthidium psoraleae Robertson (?).

Keremeos, B. C., June 18, 1919 (E. R. Buchell), 1 ♂; Penticton, B. C., June 7, 1919 (E. R. Buckell), 1 ♂; Vaseaux L., B. C., June 12, 1919 (E. R. Buckell), 1 ♂; Lillooet, B. C., June, 1916 (A. W. A. Phair), 1 ♂; Fort Wrigley, McKenzie River, July 25, 1922 (C. H. Crickmay), 1 ♂.

With some hesitation I assign to *psoraleae* the group of males from the above-mentioned localities, which seem to share the structural characters noted by Robertson and fall within the range of variability that he indicates with respect to the maculations. They differ somewhat among themselves, however, structurally and this has made their determination the more difficult. Robertson says of the female of *psoraleae* "closely punctured," and presumably this applies also to the male. While all the specimens before me are closely punctured on the head and thorax, the punctation of the abdomen is in four of them relatively light and at least at the basal portion of the several segments not especially dense. The fifth specimen, however,—the one from Fort Wrigley—has much heavier and denser punctation on the abdomen. It agrees in this respect with a specimen from Springview Bridge, Brown Co., Nebraska, that was collected by Crawford in June, 1902, and is doubtfully assigned in the U. S. National Museum collection to *psoraleae*. It differs structurally from this Nebraska specimen, however, in having a median longitudinal carina on segment 6. Robertson mentions a longitudinal carina on segment 6 of the female of *psoraleae* but says nothing about a similar structure in the male.

I have also before me an insect collected in August by F. H. Snow at the base of Humphrey's Peak (9500 ft.) in Arizona (loaned by Cornell University). Its pygidium and its apical sternite are like the corresponding parts in the Canadian specmeins. The punctation of its abdomen about corresponds to that of the Fort Worth specimen, but it lacks a carina on segment 6. Its maculations are yellow rather than cream-colored, and it has interrupted L-shaped stripes bordering the mesoscutum.

Yet another specimen, from Dulzura, California, has the hook-like inbent termination to its otherwise rather broad lateral lobes that is characteristic of the Canadian specimens, and the armature of its apical sternite and its punctation are also in agreement with theirs. Its maculations are, however, strongly yellow and much fuller than indicated for *psoraleae*. Thus there are stripes on the scape, on the apical half of all the femora beneath, while all of the tibiae as well as the basitarsi are externally yellow, the axillae as well as the scutellum have maculations, and there is a stripe on each side of the anterior border of the mesoscutum.

We have evidently here an insect of rather wide distribution that shows certain varietal differences from region to region (how constant these are could only be ascertained if a larger series were available). Without the type of *psoraleae* before me it is hard to know which one, if any, of the several specimens mentioned fully accords with Robertson's insect. It is possible, too, that they come rather close to what Cockerell has designated as *titusi*. Cockerell's description of the armature of the apical sternite of *titusi* seems to fit them well. But I have not seen the type of *titusi* and so cannot speak with certainty. In 1925 Cockerell assigned provisionally to *titusi* specimens that were unorthodox, among other respects, in having the scutellum entirely black. This is the condition likewise in the Canadian specimens before me and was noted by Robertson in the case of one of his males from Illinois.

Since the above was written there have been submitted to me through the kindness of Dr. O. A. Stevens, of North Dakota Agricultural College, certain bees taken by him in North Dakota. Among them are a male and a female collected at Union on July 26, 1917. The male belongs to the group here discussed as *psoraleae*, the female is *clypeodentatum*. In size and general appearance they are much alike and suggest the probability that they are one species. Swenk in describing *clypeodentatum* from the female said of it: "This species is allied to *psoraleae*." One of the distinctions he drew between the two insects is the difference in the number of the teeth on the clypeus of the female, but this I have found a very variable character in the specimens of *clypeodentatum* that I have examined. These specimens have on the pygidium what I should call a longitudinal carina (in agreement with Robertson's *psoraleae*), namely, one running lengthwise of the insect even though it be along the shorter axis of the tergite in question. Harder to reconcile is Robertson's reference to lateral teeth on the pygidium of his *psoraleae* female unless it be that the irregularly serrate character of the truncated apex of the pygidium has lent itself to this interpretation. It seems wiser for the time being still to retain the name of *clypeodentatum* until all doubts can be resolved, but my suspicion is that *psoraleae* and *clypeodentatum* may be one.

Anthidium clypeodentatum Swenk.

Penticton, B. C., June 29, 1919 (E. R. Buckell), 1 ♀ ; Banff, Alberta, June 28, 1916 (Sanson), 1 ♀, and Aug. 17, 1911 (Sanson), 1 ♀ ; Lethbridge, Alberta, July 9, 1909 (J. B. Wallis), 1 ♀ ; Calgary, Alberta, July 29, 1916 (F. W. L. Sladen), 1 ♀ ; Aweme, Man., July 7, 1917 (N. Criddle), 2 ♀ ♀ ; July 20-25, 1914 (N. Criddle), 2 ♀ ♀, and July, 1920 (P. N. Vroom), 1 ♀.

This species was described by Swenk from Nebraska. In the collection of the U. S. National Museum is a specimen from Flagstaff, Arizona. The strong representation of this species in Canada is the more impressive because of its apparent rarity in the United States.

Great variability is shown in the number, regularity, and distinctness of the teeth of the clypeus, which in some of the specimens number as much as ten (Swenk speaks of "about six"). Only two of the specimens share all of the markings specified by Swenk. One of the remaining specimens has the lines on the anterior margin of the mesoscutum, but lacks those above the tegulae. The rest have marks neither on the anterior margin of the mesoscutum nor above the

tegulae, and several of these also lack maculations on the tubercles and on the axillae. Moreover the first segment is sometimes four-spotted instead of banded and in the extreme case merely two-spotted, the inner maculations being lacking. Yet all of the specimens are certainly essentially one, being easily assignable to *clypeodentatum* by their distinctive clypeus and scarcely less distinctive sixth segment with its truncate extremity (serrated in many of the specimens) and bifid tooth.

Anthidium atriventre Cresson.

Keremeos, B.C., July 1, 1923 (C. B. Garrett), 1 ♀.

This species was described from California, but I have seen in the U. S. National Museum a male from Sprague, Washington, and it is recorded also from Wyoming. This is, I believe, the first record of the occurrence of the species in Canada.

Heteranthidium ridingsii (Cresson).

Florida, 1 ♀.

Anthidiellum robertsoni (Cockerell).

Summerland, B.C., Aug. 10, 1916 (F. W. L. Sladen), 1 ♂, 1 ♀.

The northern limit of this species was previously believed to be Oregon.

Paranthidium jugatorium (Say).

Yellow River, Wis., July 18-19, 1 ♀, and Prescott, Wis., July 28-31, 1 ♂.

Paranthidium jugatorium lepidum (Cresson).

Marion, N.C., July 26, 1924 (T. B. Mitchell), 1 ♂, caught on *Coreopsis stellata;* Raleigh, N.C., Aug. 23, 1921 (C. S. Brimley) 1 ♀.

This insect has previously been reported from Georgia and from Tennessee but this is, I believe, the first record from North Carolina.

Dianthidium floridiense Schwarz.

Florida, 1 ♀.

Dianthidium sayi Cockerell.

Medicine Hat, Alberta, Aug. 20, 1916 (F. W. L. Sladen), 1 ♂.

D. sayi was recently reported from Montana. It is interesting, therefore, to note its presence also in the adjoining province of Alberta. The insect is likewise recorded from Missouri (type), Nebraska, Kansas, Colorado, and Utah.

Dianthidium ulkei (Cresson).

Fairview, B.C., Aug. 7-21, 1919 (E. R. Buckell), 2 ♀ ♀; Keremeos, B C., July 30, 1919 (W. B. Anderson), 1 ♂; Vernon, B.C., Aug. 25, 1919 (F. W. L. Sladen), 1 ♂; Summerland, B.C., Aug. 10, 1916 (F. W. L. Sladen), 1 ♀.

This has, I believe, not been previously reported from British Columbia.

Dianthidium simile (Cresson).

Ottawa, Ontario, July 7, 1913 (F. W. L. Sladen) 1 ♀; Port Hope, Ontario, July 28, 1895, 1 ♂, 2 ♀ ♀; Sudbury, Ontario, July 7, 1889, 1 ♂, and August 18, 1889, 1 ♂, 1 ♀.

This insect has been known for some time from Ontario and localities in the eastern part of the United States.

Dianthidium pudicum (Cresson).

Lethbridge, Alberta, July 27-28, 1916 (F. W. L. Sladen), 1 ♂, 2 ♀ ♀;

Medicine Hat, Alberta, July 17, 1917 and Aug. 1, 1917 (F. W. L. Sladen), 3 ♂ ♂ ; Westbank, B.C., July 20, 1919 (E. R. Buckell) ; Okanagan Falls, B. C., July 26, 1917 (F. W. L. Sladen), 2 ♀ ♀ .

The presence of *D. pudicum* in Alberta is not altogether surprising as it forms part of the fauna of the neighboring state of Montana.

Dianthidium subparvum Swenk.

Walhachin, B.C., June 27, 1918 and Aug. 30, 1917 (E. R. Buckell), 2 ♀ ♀ ; Okanagan Falls, B. C., July 21, 1917 (F. W. L. Sladen), 1 ♂ ; Summerland, B. C., July 20, 1917 and Aug. 9-10, 1917 (F. W. L. Sladen), 1 ♂ , 4 ♀ ♀ ; Salmon Arm, B.C., July 4, 1914 (F. W. L. Sladen), 1 ♂ (this is the specimen that shows the extreme of reduced maculation noted below) ; Penticton, B.C., Aug. 7, 1916 (F. W. L. Sladen), 1 ♂ ; Vernon, B.C., July 25, 1917 (F. W. L. Sladen), 1 ♂ , and July 28, 1920 (M. H. Ruhmann), 1 ♂ ; Victoria, B.C., July 14, 1916 (F. W. L. Sladen), 1 ♂ .

The females accord with Swenk's description in lacking maculations on the scutellum, but the anterior margin of the mesoscutum in most of the specimens has a traceable vestige of yellow instead of being wholly immaculate. The males also lack maculations on the scutellum and one or two of them have no spots on the anterior margin of the mesoscutum although the majority are in agreement with Swenk's allotype from Okanagan (also the locality from which one of the specimens herein considered was obtained) in having "two small spots" in this area of the thorax. The abdominal maculations in the male are exceedingly variable, showing all degrees of intergrade between the banded condition described by Swenk to the reduction of these bands in one specimen to four well separated spots on segments 2-5 and a completely immaculate condition on segments 6 and 7. (The four-spotted condition of the greater number of the abdominal segments recalls the similar condition in the female that Cresson described as *pudens*). The undermaculated male has the tubercles entirely black. It represents a condition even more extreme than that which I recently described as *semiparvum gallatinae* and raises doubt whether any valid segregations of varieties can be made within this group. Indeed, with these North Pacific specimens before me, not available when I described *semiparvum* from Utah, I am compelled to recognize that differences which I then thought valid intergrade or merge with individual differences noted in the North Pacific specimens here assigned to *subparvum*. In some of these specimens the third-coxal tooth is of the rather short bulbous type, in other cases very well developed, fully justifying Swenk's term "large stout yellow spines."

In addition to the specimens listed above, there are four (all females) taken at Victoria, B.C., July 14, 1916 (F. W. L. Sladen), at Westbank, B.C., July 20, 1919 (E. R. Buckell), and at Summerland, B.C., July 20, 1917 (F. W. L. Sladen) that have maculations, though faint, on the scutellum and more or less well-developed spots on the anterior margin of the mesoscutum. They therefore accord with *parvum* rather than with *subparvum*, and it would seem that *subparvum* should be looked upon not as an independent species but as expressing a tendency toward the suppression of maculation that in some localities (especially those of the Northwest) *parvum* is apt to evidence.

REVISION OF THE AMERICAN SPECIES OF ARCHYTAS (TACHINIDAE, DIPTERA).*

BY C. HOWARD CURRAN,
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(Continued from page 208)

Archytas antillicolla Curran.

(Fig. 6).

Amer. Mus. Novitates No. 260 p. 2, 1927.

Black, antennae partly and the palpi apically, reddish; face and cheeks yellow. Superficially very similar to *daemon* Wiedmann from Brazil but at once distinguished by the short, fine yellow hair on the parafacials and cheeks and the shape of the male genital forceps, which are ridged as in *apicilera* Walker. Length, 11.5 to 13 mm.

Male. Face and cheeks pale yellow, white pollinose; pollen of the front and upper half of the occiput with ochreous tinge, the parafrontals rather thinly pollinose. Front at vertex five-sevenths as wide as either eye, strongly widening anteriorly, the bristles forming two rows anteriorly and there are two bristles placed side by side in front of the upper frontal, the three or four upper pairs of frontals reclinate; frontal vitta rusty reddish or brown, one-third as wide as either parafrontal, strongly widening anteriorly; frontal hair black, fairly long; vetical bristles strongly cruciate; outer verticals divergent; post-ocellars fairly strong. The occipital cilia extend to the lowest fourth of the eyes, the pile whitish with yellowish tinge. Palpi reddish brown, somewhat reddish apically. Antennae with the first two and much of the third segment reddish, or almost wholly blackish or brown with the incisures broadly reddish; third segment convex above, tapering to a rounded point below; basal aristal segment short, the second three times as long as wide, the apical segment tapering to its tip, distinctly pubescent.

Thorax blue-black, the scutellum brownish black or brownish, the thorax with rather thin grayish yellow or cinereous pollen, the vittae very indistinct; pollen of scutellum brownish. Three sternopleurals; dorso-centrals, 3-4; scutellum with five pairs of marginals, the first and fifth pairs weak, the fifth or apical pair sub-erect, not cruciate, the disc with short, coarse hair and three or four pairs of weak bristles. Hair of thorax black except on the middle of the propleura.

Legs black; pulvilli elongate, reddish yellow.

Wings strongly tinged with blackish brown, the costal region broadly luteous on the basal half. Squamae brown, halteres reddish brown.

Abdomen shining black, somewhat metallic; second segment with pair of marginals, the third and fourth each with a marginal row, the latter with discals on the apical third, sternites with strong bristles. Lobes of fifth sternite with two arms apically, both short; ridges of posterior forceps very high and thin, the forceps fused, hollowed, the arms concave. The genitalia and lobes of the fifth sternite are similar to those of *basifulva* Walker, but the black haired pleura will at once distinguish the species.

Female. Front a little narrower than either eye, with two pairs of orbitals; palpi usually reddish; pulvilli short; fourth abdominal segment with tawny pollen laterally and ventrally.

♂, Aibonito, Porto-Rico, July 14-17, 1914 (F. E. Watson); 3 ♀, Aibonito, June 1-3, 1915, (A. J. Mutchler); ♀, Maricao, July 27, 1914, (F. E. Watson); 3 ♂ Adjuntas, June 26, 1915, (F. E. Lutz,) and July 14-17, 1914, (F. E. Watson); ♂, Arecibo, June 24-26, 1915, (F. E. Lutz, by sweeping); ♂, Barros, June 4, 1915, (F. E. Lutz); ♂, Caguas, May 28-29, 1915, (F. E. Lutz), all Porto Rico; 2 ♀, Jamaica, Dunrobin District, Mandeville, Manchester, Dec. 12, 1919, (F. E. Watson) and Nov 29, 1919; ♀, Kartabo, British Guiana, May 21, 1924.

Archytas unguis Townsend.

(Figs. 7, 8).

Makasinocera unguis Townsend, Proc. U. S. N. M., XLXIX, 432, 1916.

A blackish or castaneous species superficially resembling *pilosa* but readily distinguished by the shape of the antennae and furcate arm of posterior forceps. Length, 14 mm.

Male. Parafrontals and most of occiput blackish in ground color, the former grey the latter rather ochreous pollinose. Front about as wide as eye, strongly widened anteriorly; frontal vitta over half as wide as parafrontal, strongly widened in front; frontal bristles in two irregular rows, the inner ones rather weak. Hair of front black, on parafacials and cheeks yellow with strong black hairs intermixed; pile of occiput yellow. Palpi reddish yellow, with black bristly hairs. Antennae reddish, the third segment wholly black (fig. 8). Arista black, the basal segment less than half as long as penultimate. Face and cheeks white pollinose.

Thorax black with slight aeneous or bluish reflections, covered with moderately abundant greyish ochreous pollen which becomes thin posteriorly on the mesonotum. Scutellum brownish red, with three or four pairs of rather strong, horizontal marginals, a weaker sub-marginal row and normally a weak decussate pair of apicals, the bristly hairs on the disc mostly erect. Pile of pleura about half black, on mesonotum wholly black. Three sternopleurals.

Legs blackish, tibiae reddish brown, anterior femora greyish yellow pollinose behind. Pulvilli elongate, yellowish.

Wings strongly smoky, the bases darker. Squamae brownish, halteres brownish red.

Abdomen castaneous with blackish base and broad median vitta on at least the second and third segments. First segment without bristles, second with marginal pair, third with marginal row; fourth with two rows of discals on apical two-thirds, a weaker marginal row and some scattered bristles laterally. Lobes of fifth sternite angularly produced inwards at inner apex. Posterior forceps strongly concave, the median arm strongly upturned and deeply excavated apically (more so than in figure as the view of the arm is sub-dorsal), the sides of the basal portion with long abundant black hairs. The lower arm of the outer forceps forms a fairly large globular process which is attached to the upper arm on almost its whole length and is shorter than that arm.

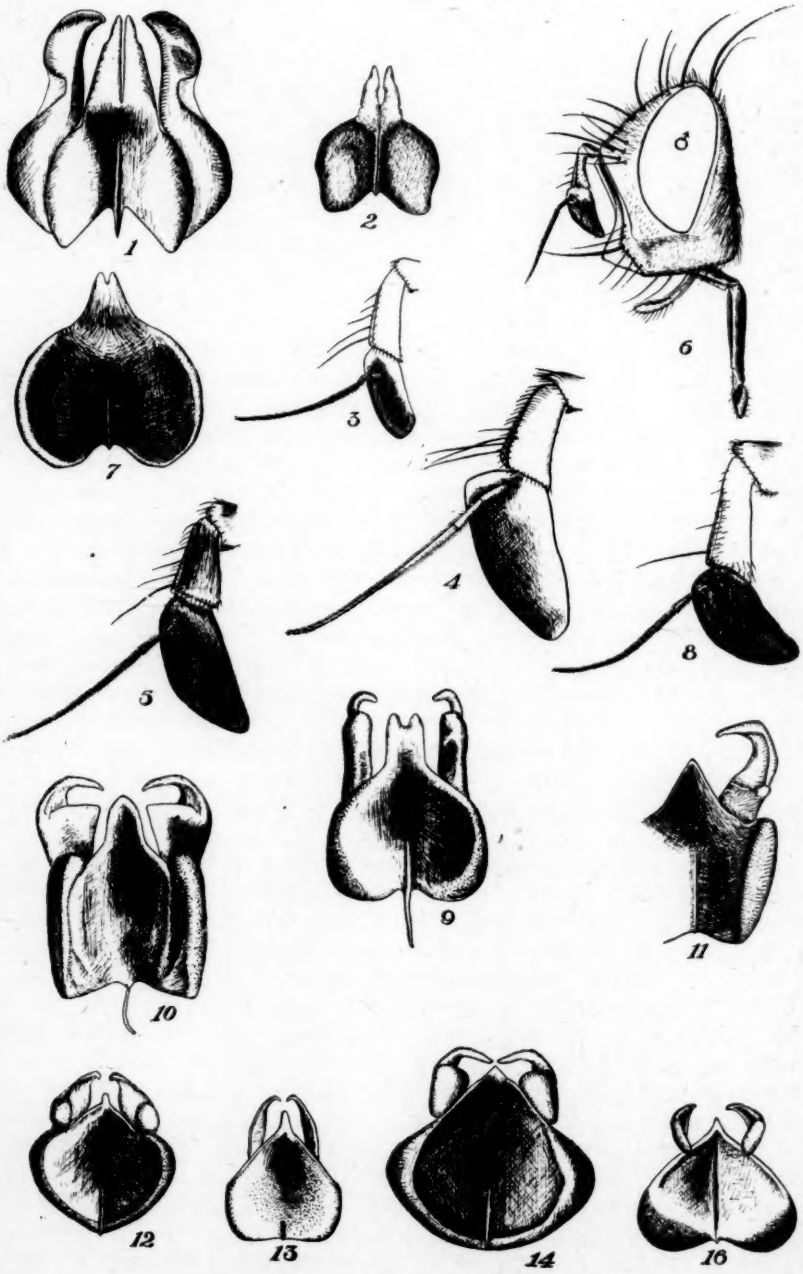
The above description is from a paratype loaned by the United States National Museum. The species was described from Peru.

Archytas townsendi n. sp.

(Fig. 9).

Black; sides of intermediate abdominal segments reddish castaneous, their bases very narrowly whitish pollinose, the sides more broadly so; second

CAN. ENT. VOL. LX. PLATE 17.



AMERICAN SPECIES OF ARCHYTAS.

segment without marginals. Length, 17 mm.

Male. Face and cheeks yellow; head yellowish white pollinose, the front and occiput yellowish. Front about half as wide as eye, strongly widening on anterior two-thirds; secondary row of frontals restricted to lower one-third. Pile of head yellowish, black on parafrontals, fine on face and cheeks. Palpi reddish. Antennae reddish, third segment mostly brown, narrow; penultimate aristal segment four times as long as wide, the preceding segment wider than long.

Thorax black, with moderately abundant greyish ochreous pollen, the vittae distinct; scutellum brownish. Hair black; propleura and sternopleura yellow pilose.

Legs black, pulvilli elongate, reddish yellow.

Wings greyish hyaline with luteous tinge, yellow basally with a roundish sub-basal brown spot. Squamae pale brown, the base paler, the margins deep brown. Squamae reddish brown with yellowish knob.

Abdomen blackish castaneous with the intermediate segments reddish castaneous except for a broad median vitta and broad apex of the third segment. Fourth segment conspicuously greyish white pollinose. Lobes of fifth sternite with an upwardly inclined, moderately large sub-triangular apical production on inner apex. Outer forceps with a large, broad arm next to the posterior forceps and a narrow, apically curved arm. Posterior forceps moderately concave, the arm broad and excised at the apex, the ridges not strongly developed.

Type.— ♂, San Rafael, Vera Cruz, Mexico, (C. H. T. Townsend) in the United States National Museum.

Archytas vexor n. sp.

(Fig. 10)

Related to *townsendi* but more slender and with the arm of the posterior forceps tapering and not excised. Black, abdomen castaneous with fourth segment and median vitta black. Length, 15 mm.

Male. Front half as wide as eye, yellow pollinose; head white pollinose. Three or four bristles in a secondary frontal row on lower third. Pile with yellow tinge. Cheeks and parafacials with fine yellowish hair. Palpi reddish yellow. Antennae reddish, third segment largely ferruginous; arista ferruginous, the penultimate segment four times as long as wide, the preceding segment wider than long.

Thorax moderately greyish yellow pollinose, the mesonotum somewhat shining from dorsal view, the narrow vittae distinct. Scutellum brownish. Hair black; sternopleura and propleura yellow pilose.

Legs black; pulvilli elongate, yellowish.

Wings cinereous hyaline, luteous basally with darker sub-basal spot. Squamae brownish grey the upper lobe yellowish, the borders yellow.

Median abdominal vitta narrow; bases of intermediate segments, apex of third narrowly, and whole of fourth cinereous pollinose, the sides of the abdomen obscurely pollinose. Second segment without marginals, third and fourth with row, the fourth with discals on apical half. Lobes of fifth sternite with weak, subtriangular, upwardly directed, lobe at inner apex. Outer forceps with a bulbous swelling and a very strongly curved arm. Arm of posterior forceps broad, tapering apically, the ridges broad, highest anteriorly, projecting somewhat forwards, the base deeply concave.

Type.— ♂, and allotype, ♀, Chapada, Brazil (Williston Collection) in American Museum of Natural History.

Archytas piliventris Wulp.

Echinomyia piliventris Van der Wulp, Tijdschr. v. Ent., XXVI, 22, 1883; Biol. Cent. Amer., II, 1903.

Black, very conspicuously cinereous pollinose, the abdomen frequently mostly brownish red, the scutellum luteous. Length, 9 to 14 mm.

Male. Front about as wide as either eye, the parafrontals with dull ochreous pollen, the pollen elsewhere white, often with ochreous tinge on upper part of occiput; pile whitish, with yellowish tinge above. Cheeks and parafacials with fine yellow hair. Palpi reddish yellow. Antennae narrow; reddish, the third segment mostly and the arista, black; penultimate aristal segment about six times as long as wide, the basal segment twice as long as wide.

Thorax moderately cinereous pollinose, the ground color concealed from posterior view, the vittae distinct. Pile black, often yellow on the sternopleura and always so on the propleura.

Legs black, with grey pollen; pulvilli yellow. Wings pale cinereous. Squamae white or with yellow tinge. Halteres reddish with brown knob.

Abdomen black, the sides and apical segment more or less reddish, or the ground color may be chiefly brownish red with the basal segment, apices of the two following segments and usually a broad median vitta, darker. About the apical fourth of the intermediate segments is shining, appearing bare in most views, the fourth segment practically wholly pollinose. Second segment with pair, third and fourth with row of marginals, the fourth with two rows of discals on apical one-third. Fifth sternite with the lobes broadly separated with a deep preapical excision the lobes narrow and directed obliquely towards the base, the apex rather transverse. Outer forceps broad, the lower corner emitting a broad, inwardly directed arm, and with a bulbous swelling at the corner next to the posterior forceps. Posterior forceps about as broad as long, rather shallowly concave, the median arm short, broadly excised at apex, scarcely turned upwards.

Female. Front two-sevenths wider than eye, with two pairs of orbitals; second abdominal segment usually without a pair of marginals, the abdomen more often brownish red and more heavily pollinose.

Numerous specimens from: Argentina, Brazil, Peru, British Guiana, Colombia, Panama, Costa Rico, Mexico, Cuba, Jamaica, Porto Rico, Haiti, and the United States as follows: College Sta., Texas, (H. J. Reinhard); ♂, reared from Corn Stalk Borer, Limon, Calif.?, Aug. 3, 1918 (H. F. Dietz); ♂, Laredo, Texas, March 26, 1909; ♂, Audubon Park, La., May 12, 1914, from pupa of Mexican Army Worm, (U. C. Loftin); ♀, Calvert, Texas, parasite of *H. armiger,* (A. L. Quaintance).

The genitalia are very similar to those of *pollinosus* and the two species are closely related. The ♀ of *pollinosus* always bears long marginals on the second segment, whereas in *piliventris* these are rather short when present, which is rarely.

Archytas chilensis n. sp.

(Fig. 11).

Black, face and cheeks yellow; scutellum luteous; abdomen without pollen. Length, 12 to 14 mm.

Male. Head white pollinose the occiput and parafrontals above with yellow tinge; frontal vitta pale rusty reddish; a secondary row of frontals; outer verticals long and strong. Occipital pile pale yellowish; cheeks with sparse black hair, half as wide as eye-height; parafacials with black hair on lower half, yellow above. Palpi reddish; antennae black, the second segent often brownish red; penultimate aristal segment four times as long as wide, twice as long as preceding segment.

Thorax and scutellum with ochreous grey or brownish grey pollen, the mesonotum with more ochreous or brownish tinge. Hair black; propleura wholly and lateral margin of mesonotum pale haired.

Legs black; femora not conspicuously pollinose; pulvilli elongate.

Wings cinereous hyaline; yellowish basally. Squamae white; halteres brownish.

Abdomen wholly shining black; second segment with pair of marginals, third with row, fourth with bristles on apical half. Lobes of fifth sternite almost transverse apically; outer forceps with a single arm; posterior forceps with the apical portion turned almost at right angle, the lobes broad and high, as broad as long from lateral view.

Female. Differs only sexually, the second segment inclined to show a large brownish red spot on either side.

Holotype.— ♂, Allotype ♀, Valparaiso, Chili, (A. Faz); in United States National Museum.

Paratypes.— ♀, Santiago, Chili; 2 ♂, Chili (E. C. Reed); 2 ♂, 8 ♀, Limanche, Chili, (A. Faz). Paratypes in Canadian National Collection and Deutsches Ent. Museum.

Archytas aterrima Desvoidy.

(Fig. 12)

Jurinia aterrima Desvoidy, Myodaires, 35, 1830.
Jurinia leucostoma Desvoidy, Myodaires, 37, 1830.
Tachina atra Walker, Dipt. Saund., 273, 1852.
Archytas aterrima Coquillett, Rev. Tach. 143, 1897.

Black, the abdomen wholly shining above. Length, 10 to 16 mm.

Male. Pollen of head varying from white to brassy yellow, the parafrontals less thickly pollinose than elsewhere. Front hardly as wide as either eye. Pile yellowish, extending somewhat on to the cheeks which bear coarse black hair. Parafacials black haired. Palpi reddish. Antennae reddish the third segment often chiefly black or brown, unusually large; second aristal segment not much longer than the first, both strongly elongate.

Pleura and mesonotum in front moderately grayish ochreous pollinose; the mesonotum shining, appearing thinly grey pollinose from posterior view, the vittae not conspicuous. Scutellum wholly dark. Pile black.

Legs black; middle tibiae with four or five antero-dorsal bristles.

Wings cinereous hyaline, somewhat yellow towards the base. Squamae white. Knob of halteres brown.

Abdomen shining black, the incisure of first and second segments broadly, thinly whitish pollinose, the bases of the second and third segments often very narrowly so. On the under surface there is conspicuous whitish pollen on the fourth segment and towards the middle. Lobes of fifth sternite slightly oblique

apically, the inner corner sub-angulate. Outer forceps composed of a large bulbous swelling contiguous to the posterior forceps and with a long, moderately curved arm.

Posterior forceps with the apex curved strongly upwards, deeply concave. Second abdominal segment with pair of strong marginals, third and fourth each with a row, the fourth with two rows of discals on apical half.

Female. Front a little wider than either eye; intermediate abdominal segments with slight metallic bluish sheen above.

Specimens.—New Brunswick, Quebec, Ontario, Manitoba, Kansas, Georgia, Texas, District of Columbia, Virginia, Maryland, Arkansas, Ohio, New York, New Jersey, Pennsylvania, Rhode Island.

Archytas instabilis n. sp.

(Fig. 13).

Superficially this species is so similar to *Archytas aterrima* Desv. that it is almost impossible to separate it without spreading the genitalia, although the pollen on the second segment is much more evident. Length, 11 mm.

Black, the abdomen shining above. Length, 10 to 16 mm.

Male. Pollen of head varying from white to brassy yellow, the parafrontals less thickly pollinose than elsewhere. Front hardly as wide as either eye. Pile yellowish, extending somewhat on to the cheeks which bear coarse black hair. Parafacials black haired. Palpi reddish. Antennae reddish the third segment often chiefly black or brown, unusually large; second aristal segment not much longer than the first, both strongly elongate.

Pleura and mesonotum in front moderately grayish ochreous pollinose, the mesonotum shining, appearing thinly grey pollinose from posterior view, the vittae not conspicuous. Scutellum wholly dark. Pile black.

Legs black; middle tibiae with four or five antero-dorsal bristles.

Wings cinereous hyaline, somewhat yellow towards the base. Squamae white. Knob of halteres brown.

Abdomen shining black, the incisure of first and second segments broadly, thinly whitish pollinose, the bases of the second and third segments often very narrowly so. On the undersurface there is conspicuous whitish pollen on the fourth segment and towards the middle. Lobes of fifth sternite slightly oblique apically, the inner corner sub-angulate.

Outer forceps composed of a single long arm which is sharply curved inwards at the apex, the posterior forceps shallowly excavated, the arm fairly long and moderately curved upward.

Holotype—♂, Hewitt, New Jersey, June 18, 1904 (Wm. T. Davis), No. 2828 in the Canadian National Collection, Ottawa.

Paratype—♂, Occoquan, Va., Aug. 22, 1920, in United States National Museum.

Archytas lateralis Macq.

(Figs. 14, 15)

Echinomyia lateralis Macquart, Dipt. Exot., II (3), 42, 1843.
?Tachina candens Walker, List Dipt., IV, 720, 1849.
Jurinia apicalis Jaennicke, Neue Exot. Dipt., 82, 1867.
Jurinia gonoides Bigot, Ann. Soc. Ent. France, 78, 1878.
Jurinia lateralis Bigot, Bull. Soc. Ent. France, p. cvi, 1888.
Archytas lateralis Coquillett, Rev. Tach., 143, 1897.

Black, the abdomen usually very broadly red on the sides on sub-basal half, the thorax thickly pollinose. Length, 10 to 15 mm.

Male. Face and cheeks yellow; head whitish pollinose, the front and occiput above with more or less ochreous tinge. Front one-seventh wider than eye; hair black, sparse. Occipital pile yellowish, extending on to the lower part of the cheeks which bear sparse black hair, the parafacials black haired. Palpi reddish. Antennae reddish, the third segment brown, rather narrow; basal aristal segments sub-equal, elongate.

Thorax rather thickly ochreous gray or grayish ochreous pollinose, the vittae not conspicuous. Scutellum reddish. Hair black; propleural pile black.

Legs black, the tibiae sometimes brownish red.

Wings cinereous hyaline, somewhat yellow basally and in front. Squamae whitish, with pale yellow border. Halteres reddish with brown knob.

Abdomen shining, the broad sides of the basal three segments dark reddish, the base of the first and apex of the third usually broadly black, the red color rarely almost wanting, often very greatly reduced, always leaving a broad, median black vitta. Second segment with pair, third and fourth with row of marginals, the fourth with two or three rows of discals on apical three-fifths. Lobes of fifth sternite contiguous at base, the angles broadly rounded. Outer forceps forming a bulbous swelling next to the posterior forceps and with an inwardly curved arm. Posterior forceps rather deeply concave, the median arm strongly curved upwards.

Female. Front one-third wider than either eye. Abdomen usually with the reddish color obscure, sometimes wholly wanting, the fourth segment with two rows of discals.

♂, Seton Lake, Lillooet, B. C., June 1, 1926, (J. McDunnough); ♂, Medicine Hat, Alta., Aug. 22 (F. S. Carr); 61 ♂ ♀, New Mexico, (Gaumer, Snow); ♂ Laguna, Texas, July; ♂, Florida; ♂ Spring Creek, Decatur Co., Georgia; 5 ♂ ♀, (Snow), 2 ♂, Bailey, Colorado; Aug., (Snow), 27 ♂ ♀, Oak Creek Canyon, and 7 ♂ ♀, Santa Rita Mts., Arizona; (Snow), 21 ♂ ♀, Southern Arizona (Snow).

Archytas sibillans n. sp.

(Fig. 16)

Black; head mostly yellowish; abdomen mostly reddish on the basal two-thirds. Length, 9 to 11 mm.

Female. Cheeks and face very pale yellowish, white pollinose; occiput and front blackish pale ochreous pollinose, the parafrontals with thin pollen; frontal vitta rusty reddish, less than half as wide as either parafrontal. Front almost as wide as either eye, the upper three or four pairs of frontals reclinate; two pairs of proclinate orbitals and a reclinate one half way between them but near the frontal row. Pile of occiput yellowish. Hair of cheeks coarse, mostly black; hair of face black. Palpi reddish. Antennae reddish, the third segment mostly brownish, not much longer than the second, convex apically on upper surface; arista mostly ferruginous, the basal segment almost one-half as long as the penultimate one.

Thorax blue-black, thickly cinereous pollinose, only lightly so behind the suture. Four pairs of posterior dorsocentrals, three sternopleurals; three pairs of marignal scutellars and a weaker, cruciate apical pair.

Legs black; pulvilli yellowish.

Wings cinereous hyaline, narrowly brownish tinged along the veins, the

costal border conspicuously brownish on the basal half or more.

Abdomen with the first three segments reddish, the first mostly black dorsally, the second with a broad median vitta, the third with the apical half and median vitta which narrows slightly anteriorly to join that of the second segment, black; apex of fourth segment reddish. Abdomen without pollen. Second segment with a pair of marginals, the third and fourth each with a row, the latter with an irregular row of discals.

Male. Pulvilli moderately elongate; third abdominal segment only narrowly black apically towards the sides.

♀, Kartabo, British Guiana; ♂, Puerto Bermudez, Peru, July 12-19, 1920.

(To be continued)

SOME CORIXIDAE FROM NORTHERN STATES AND CANADA.*

BY H. B. HUNGERFORD,
University of Kansas, Lawrence, Kansas.

The following species are described as new:

Arctocorixa compressoidea sp. n.

Size: 5.4 mm. long.

Color: Dark. Seven light bands of pronotum narrower than the dark ones and caudal ones deeply impressed; third and fourth bands often united on ends; longitudinal median pale line on pronotum. Pale transverse bands of clavus oblique and entire on basal half; apical ones slender, broken, crooked and few in number. Pale lines of corium also slender, broken, sometimes mere transverse dashes arranged in longitudinal series. Membrane smoky brown, pattern almost obliterated. Elytral suture, line between corium and membrane and embollium reddish yellow. Vertex in all my specimens more or less darkened. Limbs and venter pale.

Structural Characteristics: A rugulose species. On some specimens scattered long white hairs on elytra. Head short, interocular space as wide as an eye. Apex of pronotum definitely angulate. Metaxyphus normal. Male fovea oval, small. Male pala as seen from above much like *A. compressa* Abbott, the distal pegs long and on an overhanging ledge, large stridular area on base of front femur. Strigil fairly large, nearly circular and composed of about ten striae. Male genital capsule as shown in figure 9. The notched tip of the right clasper is noteworthy.

Described from the following series:

10 specimens, Douglas Lake Michigan, Sedge Point Pool, July 13, 1923.
5 specimens, Douglas Lake Michigan, Sedge Point Pool, July 6, 1923.
8 specimens, Douglas Lake Michigan, Sedge Point Pool, July 3, 1923.
10 specimens, Douglas Lake Michigan, East Fish Tail Pool, July 6, 1923.

Other specimens have been taken from the region. Holotype and allotype in University of Kansas Entomological Collection.

*—Contribution from the Biological Station of Univ. of Michigan.

CAN. ENT. VOL. LX. PLATE 18.

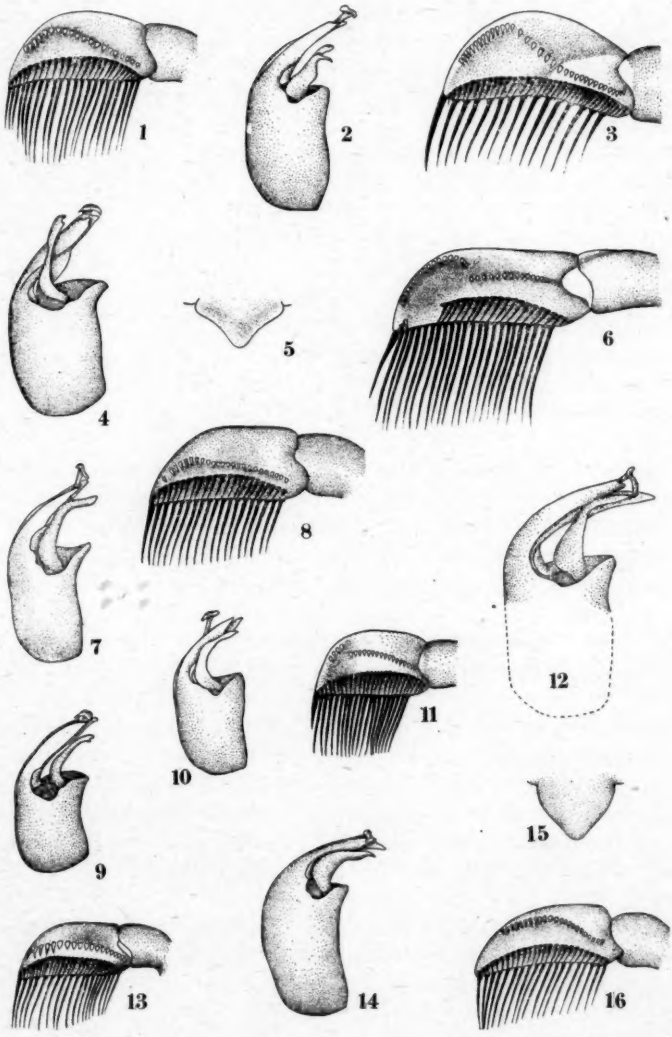


Fig. 1. *Arctocorixa mackinacensis* sp. new, pala of male. Fig. 2. *Arctocorixa dakotensis* sp. new, genital capsule of male Fig. 3. *Arctocorixa dakotensis* sp. new, pala of male. Fig. 4. *Arctocorixa mackinacensis*, sp. new, genital capsule of male. Fig. 5. *Arctocorixa mackinacensis*, sp. new, metaxyphus. Fig. 6. *Callicorixa audeni*, pala of male. Fig. 7. *Arctocorixa penniensis* sp. new, genital capsule of male. Fig. 8. *Arctocorixa penniensis*, sp. new, pala of male. Fig. 9. *Arctocorixa compressoidea*, sp. new, genital capsule of male. Fig. 10. *Arctocorixa mullettensis*, sp. new, genital capsule of male. Fig. 11. *Arctocorixa mullettensis*, sp. new, pala of male. Fig. 12. *Callicorixa audeni*, sp. new, genital capsule of male. Fig. 13. *Arctocorixa compressoidea*, sp. new, pala of male. Fig. 14. *Arctocorixa hubbelli*, sp. new, genital capsule of male. Fig 15. *Arctocorixa hubbelli*, sp. new, metaxyphus. Fig. 16. *Arctocorixa hubbelli*, sp. new, pala of male.

Arctocorixa mackinacensis sp. n.

Size: 6 mm. long.

Color: Color pattern characteristic. Seven pale bands on pronotum, the third and fourth joined at their ends; a median, longitudinal, pale stripe on pronotum. Basal claval pale bands uneven and obliquely transverse; others on clavus and corium slender, undulate and longitudinal, more or less joined end to end forming two longitudinal crooked lines on corium, a row of pale blotches along the inner margin of corium. Membrane dark with transverse pale figures. Head, venter, limbs and embolium pale. Ventral basal abdominal segments may be dark in male.

Structural Characteristics: Facial fovea of male shallow, oval, ill defined. Vertex slightly produced, as seen from above in both sexes and provided with a low median, longitudinal carina on caudal half. Rear margin of head caudally produced on median line. Pronotum and hemelytra faintly pebbled, the latter not at all rugulose. Metaxyphus of usual form. Pala of male with nineteen pegs arranged as shown in drawing (Figure 1.). Femur with stridular area. Strigil .5 mm. long, oval and consisting of nine striae. Genital capsule of male as shown in figure 4.

Described from three males and three females taken by me on Mackinac Island, Michigan, August 19, 1925. Holotype and allotype in University of Kansas Entomological Collection. I have also taken one specimen from Trout Lake, Michigan, August 25, 1925; five specimens from Penny Lake, Michigan, August 8, 1924; and sixty specimens from Douglas Lake, Michigan, on various dates.

Arctocorixa penniensis sp. n.

Size: 7 mm. long in case of smallest male and 8 mm. long for largest female.

Color: General color effect dark. Pattern much like that for *A. mackinacensis* described above, but lacking the longitudinal median pale stripe on pronotum. Basal pale bands of clavus narrower than the brown. Other pale markings of clavus and corium, short, transverse lines arranged in longitudinal series. Pale line separates corium from membrane which is quite evenly covered with pale marks. Head, limbs and sides of thorax pale. Basal abdominal segments of male dark.

Structural characteristics: Facial fovea of male oval, moderately depressed, not attaining the eyes laterally. Vertex rounded, but projected beyond the curve of the eyes anteriorly, interocular space narrower than the width of eye. Pronotum, clavus and base of corium rastrate. Pronotum with low, longitudinal, median carina. Metaxyphus slightly more pointed than usual. Male pala as shown in Figure 8. Strigil very small, roughly triangular of three striae. Genital capsule of male as shown in Figure 7.

Described from twenty-one specimens taken by me in Penny Lake, Michigan, August 8, 1924. Holotype and allotype in University of Kansas Entomological Collection. I have also fifteen specimens from Douglas Lake, Michigan.

Arctocorixa hubbelli sp. n.

Size: 5.5-6 mm. long.

Color: General color light. Head, venter and limbs pale yellow. Pigment

pattern of pronotum limited on sides and anterior portion. The brown bands six or seven in number and narrower than the pale interspaces. Brown cross-bands of clavus usually effaced on base and somewhat bifurcated on apical portion. The brown markings of corium arranged in more or less distinct longitudinal series. Membrane of same general color tone as that of corium from which it is defined by a dark band bordered by a pale band.

Structural Characteristics: Head short. Frontal fovea of male a slender, well-defined, concave oval pointed below and not attaining the eyes above. Interocular space plainly narrower than an eye. Pronotum short, rounded behind; the rastrated surface limited to pigmented portion, the remainder frosty gray; clavus also rastrated. Metaxyphus as shown in Figure 15. Pala of male flattened, longitudinal depression on outside and row of from twenty-five to twenty-seven pegs on inner face, the distal twelve long (see Figure 16). The penultimate dorsal abdominal segment of male with a narrow hair-fringed lobe. Strigil small, transverse of four striae. Male genital capsule as shown in Figure 14.

Described from series containing: 9 specimens labeled "Fentress Co., Tenn., Allardt, Aug. 17, 1922, T. H. Hubbell."; 8 specimens, "Becker Co., Minn., Shell Lake, Aug. 22, 1922, H. B. Hungerford"; 8 specimens, "Louisiana 2337, C. F. Baker Collection:." 12 specimens, "Opelousas, Pilate, La.;" 1 specimen, "Woodville, Miss., 7-26-21." Holotype and allotype in Museum of Zoology, University of Michigan. Paratypes in Kansas University and University of Minnesota collections.

Callicorixa audeni sp. n.

Size: 8 mm. long.

Color: Pattern contrasting. Pronotum with about nine pale bands that are broader than the dark ones, some of which are incomplete. Pale bands on clavus for the most part extending completely across, some furcate at one end. The pale bands of corium slender, undulate and transverse. Membrane smoky brown, mottled generously with pale figures. Head, limbs and venter horn color. Vertex, anterior tibia, first and second ventral abdominal segments of male dusky. Color pattern and rastrate surface typically that of our other Callicorixas. The hind tarsus lacks the dark band in these specimens.

Structural Characteristics: Facial fovea of male broad and shallow, attaining the eye on the sides. Head short, interocular space wider than an eye. Pala of male of shape typical of the group with pegs arranged as shown in the drawing. Strigil absent and genital capsule as shown in drawing. (See Figures 6 and 12).

Described from two specimens, male and female, taken by K. F. Auden in Adams Lake, B.C., July 20, 1925.

Arctocorixa dakotensis sp. n.

Size: 7.4 mm. long. Width across head, 2 mm., females slightly larger.

Color: General color effect slightly lighter than the average. The pale ground color not lemon yellow as in *A. utahensis*. Pronotum crossed by about ten dark bars, some of those in the middle of the disk overlapping but not continuous to the opposite side, narrower than the pale bands. The elytra not showing conspicuous barring even on base of clavus. The dark figures irregular,

and on corium confluent into inconspicuous longitudinal series. Venter pale, last segment of hind tarsus black.

Structural characteristics: Surface of pronotum strongly rastrate, elytra pebbled and provided with a sparse covering of long white hairs. Facial depression of male oval, extending well above the eyes, its margin not definite. Vertex in front broadly rounded and extending somewhat beyond the eyes. Anterior half of pronotum with longitudinal carina. Metaxyphus small and narrow. Anterior pala of female longer than common, ending in a strong claw. Lower margin of pala curved to parallel the upper. The pala of male as shown in the drawing, Figure 3. Male strigil small, circular, seven striae. Strigil supported by a strong chitinized bar extending to the median line of the abdomen. The male genital capsule as shown in the drawing in Figure 2.

Described from 10 specimens taken by T. H. Hubbell in the Turtle Mountains of North Dakota, August 3, 1920.

Comparative notes: This species is related to *Arctocorixa utahensis* Hungerford, but can be distinguished by the darker color pattern, by the less prominent vertex of the head, by the shape of the male pala and male genital capsules and by the more rastrate pronotum. It is also readily determined by structural characters from *Arctocorixa bifida* Hungerford.

Arctocorixa mullettensis sp. n.

Size: 5.3 mm. long.

Color: General color, dark. The dark color reddish brown and dominant over the pale. Five pale bands on pronotum, the oblique pale bands on the base of the clavus marked, other pale bands of clavus slender, transverse, not reaching the margins. Pale figures of corium very small and arranged into three longitudinal rows. The membrane also dark with reduced pale figures.

Structural characteristics: Surface of pronotum and hemelytra strongly pebbled. Metaxyphus short triangular. Facial depression of male, faint. The interocular space narrow, vertex projects forward plainly beyond the eyes. The male strigil minute, transverse of three coarse striae. The genital capsule of the male and the pala shown in Figures 10 and 11.

Described from 24 specimens taken in Nigger Creek near Mullett Lake, Michigan, by H. B. Hungerford.

Holotype and allotype in University of Kansas collections.

A CORRECTION

Owing to a printer's error in the pagination pages 143 and 144 in the June number of the journal were omitted. On page 145 a letter was omitted from each of the new specific names proposed by Mr. W. J. Brown; these names should stand as *Agathidium maculosum* Brn. and *Collops oklahomensis* Brn.

BOOK REVIEW

Edward Meyrick: Revised Handbook of British Lepidoptera. Watkins and Doncaster, London, 1928.

For more than thirty years *Meyrick's Handbook of British Lepidoptera* has been a classic, indispensable to students of Lepidoptera, not merely in England, but in any part of the world. It is now out of print and the *Revised Handbook* is intended to take its place. It is safe to predict that it will, and that it will serve equally well to stimulate interest and sound work in this group of insects.

The present volume is modelled on the lines of the old handbook, but is considerably enlarged and modified in details, especially in the part dealing with the *Tineina*, with which group Meyrick has mainly occupied himself for many years. Instead of the six families, differentiated in the old volume, this group is now much more naturally divided into twenty-one families (out of 33 of the world), which are recognized as represented in the British Islands. Besides these a new *"Phylum"* (the term is unfortunate because it is used for much larger divisions in Zoology) has been erected for the *Nepticula* group, which in the old volume was classed in the family *Tineidae*. This innovation is hardly tenable, because it does not go far enough, but leaves the several other aculeate groups misplaced in various heterogeneous families of the "phylum." *Tineina*. The system of Spuler (Ad. Meesz), which separates all these groups into the superfamily *Aculeata* is undoubtedly more natural. They are clearly differentiated from all other Lepidoptera (except *Micropterygidae*, which may be considered a subdivision of the *Aculeata*) by the two indisputably fundamental characters, the wing-aculeation and the single sex-opening in the female.

The value, by and large, of the wing-venation as a dependable character for a natural classification is sufficiently demonstrated and accepted without further proof, but any one character, even the venation, may be over emphasized, and Mr. Meyrick's stress on this character, which has served so well in the greater part of his classification, led to misunderstanding of this group in the old volume, which has not been materially corrected in the new volume. On the one hand the fact that, for example, *Tinea, Incurvaria, Adela,* and *Prodoxus* approach each other in a primitive venation, and even in having similar primitive palpi or head-scaling does not necessarily make them closely allied; genital structures clearly prove that they are not. On the other hand the contemplation of the highly reduced venation of the *Nepticula* group without consideration of closely allied connecting links like the more primitive *Ectoedemia*, the venation of which is easily derivable from the *Micropteryx* stock, has led to Meyrick's singling out the *Nepticula* group on the mistaken ground that "No sort of approximation is found in any other Lepidoptera." Several other points in the classification are of course subject to discussion. The removal of the *Orneodidae* from the *Pyralidina* to the *Tineina* will hardly be generally accepted, both the genitalia and the larvae indicate the former relation. The inclusion of the family *Elachistidae* (*Cygnodiidae*) in the Hyponomeutid "tribe," the reduction of the family *Ethmiidae* to a genus in the *Hyponomeutidae*, and the subordination of the families *Gracilariidae* and *Coleo-*

phoridae in the Plutellid "tribe," will similarly cause dissension.

Meyrick's grouping of the families of the *Tineina* in "tribes" (superfamilies) is on the whole unsatisfactory, partly because of the very doubtful relationship of the families so grouped, and partly because, for this reason, the "tribe" cannot be, and is not defined. His differentiation of, for example, the *Hyponomeutoidea* and the *Plutelloidea* present not one single actual difference. A curious reasoning for the supposed deriation of *Argyresthia,* on the theory of the reappearance of a lost vein, is strangely at variance with Meyrick's normal logic, and there will remain considerable division of opinion about various other details of classification and the suggestions of the phylogeny; but this only adds to the stimulating quality of the book, and the fact that Meyrick states his standpoint on each question in his usual succinct and uncompromising manner will help to clarify the problems and to facilitate their discussion and ultimate solution.

The nomenclature used in the Handbook does not conform to any of the accepted international rules, but is peculiarly Meyrick's own; this causes some inconvenience, but is of minor importance and will not greatly hamper the serious student. Good synoptic keys to the families, genera, and species enable ready recognition of all British species and are most useful also for the student of exotic forms.

Mr. Meyrick deserves the thanks of all Lepidopterists for the laborious and good work done.

August Busck.

Mailed Saturday, October 6th, 1928.